Drought Contingency Plan

US Army Corps
of Engineers
New England Division

SEPTEMBER 1987

Franklin Falls Dam, Franklin, New Hampshire

MERRIMACK RIVER BASIN
PEMIGEWASSET RIVER WATERSHED

DROUGHT CONTINGENCY PLAN
FRANKLIN FALLS DAM

1987

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

SYLLABUS

This report is a compilation of basic information on the Corps of Engineers Franklin Falls Dam to aid the assessment of the project as an emergency domestic water supply source. Included are sections on project description, operating procedures, available storage capacity, water quality, and water supply systems in the region. It was not within the scope of the study to perform detailed analysis but mainly to address the emergency potential of the site and identify and discuss a variety of concerns to be considered in weighing Franklin Falls versus any other available sources of emergency supply. A review for compliance with all current applicable environmental, riparian or other laws would be required at the time of any decision to pursue drought contingency storage at the project. The Corps of Engineers would not consider drought storage activities at Franklin Falls without an official request from the State of New Hampshire.

Franklin Falls Dam is located on the Pemigewasset River in central New Hampshire. Sixteen surrounding towns have a total population of 87,600 and are serviced by 12 water supply systems. Of the 28 flood control reservoirs operated by the Corps of Engineers in New England, Franklin Falls has the lowest storage capacity per unit watershed area. For that reason it was determined that drought contingency storage could not take place at Franklin Falls due to its potential adverse impact on the primary purpose, flood control. However a low flow duration analysis was performed to determine minimum dependable flows in the river at the project that would be available under emergency drought conditions.

The water quality at Franklin Falls Dam is good and would be acceptable for public water supply following treatment.

DROUGHT CONTINGENCY PLAN
FRANKLIN FALLS DAM

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

DROUGHT CONTINGENCY PLAN

FRANKLIN FALLS DAM

1. PURPOSE AND SCOPE

The purpose of this study and report was to develop and set forth a drought contingency plan of operation for Franklin Falls Dam that would be responsive to public needs during drought periods and identify possible modifications to project regulation within current administrative and legislative constraints. This plan was based on preliminary studies utilizing readily available information. Included are a description of existing water supply conditions, the potential for allocation of reservoir storage within specified limits, an evaluation of water quality, a discussion of impacts on other project purposes, and summary and conclusions.

2. AUTHORIZATION

The authority for the preparation of drought contingency plans is contained in ER 1110-2-1941 which provides that water control managers will continually review and, when appropriate, adjust water control plans in response to changing public needs. Drought contingency plans will be developed on a regional, basin-wide and project basis as an integral part of water control management activities.

3. PROJECT AUTHORIZATION CONDITIONS

Franklin Falls Dam was authorized by the Flood Control Act of 22 June 1936, (Public Law 738, 74th Congress), and later modified by the Flood Control Act of 28 June 1938 (Public Law 761, 75th Congress). Construction of the project was initiated in November 1939 and completed in October 1943.

4. PROJECT DESCRIPTION

Franklin Falls Dam is a single purpose flood control reservoir, located on the Pemigewasset River in the Merrimack River Basin, Franklin, New Hampshire. A map of the Merrimack River Basin is shown on plate 1.

The reservoir has a total storage capacity at spillway crest (elevation 389 Ft-NGVD), of 150,600 AC-FT, equivalent to 2.8 inches of runoff from the 1,000 sq. mi. drainage area. When filled to spillway crest, a 2,800 acre lake would be created. An area-capacity table is shown on plate 2.

The physical components of the project consist of a rolled earth filled dam with rock slope protection, a concrete ogee weir spillway, and the outlet works. The outlet works consist of an 800-ft approach channel, an intake tower, two 22' wide by 19' high concrete horseshoe-shaped conduits each with four broome gates, a stilling basin and a 2,250 foot long discharge channel.

A summary of pertinent data for Franklin Falls Dam is listed on plate 3.

5. PRESENT OPERATING REGULATIONS

a. Normal Periods. During non-flood periods, inflow equals outflow at Franklin Falls. All eight gates are usually maintained at 10 ft. openings, and a normal water surface elevation of 307 FT-NGVD (approximately a 7 ft. pool) at Franklin Falls is maintained by the Eastman Falls Dam (Public Service Co. of NH) located 1.8 miles downstream.

b. Flood Periods. Franklin Falls Dam is operated to provide flood protection for the town of Franklin and in conjunction with other projects in the basin, to reduce flooding at the major industrial, residential and commercial centers further downstream on the Merrimack River. Operations for floods may be considered in three phases:

Phase I - appraisal of storm and river conditions during early development of the flood, Phase II - flow regulation of projects while the Pemigewasset and Merrimack river floodflows crest and move downstream, and Phase III -emptying the reservoir following the downstream recession of the flood.

The regulation procedures are detailed in Appendix A of the Master Water Control Manual for the Merrimack River basin.

c. Regulating Constraints.

(1) Minimum Releases. During nonflood periods outflow equals inflow. During flood periods, because of quite limited flood storage at the project, minimum releases generally range from 10,000 to 18,000 cfs.

(2) Maximum Releases. The maximum non-damaging discharge at Franklin Falls is about 18,000 cfs during the nongrowing season and about 10,000 cfs during the growing season.

6. MONITORING OF HYDROLOGIC CONDITIONS

The Reservoir Control Center directs the reservoir regulation activities at 31 New England Division flood control dams, and continually monitors rainfall, snowcover and runoff conditions throughout the region. When any of these hydrologic parameters have been well below normal for several months and it appears that possible drought conditions might develop, the Corps Emergency Operations Center (EOC) will be so

informed. The EOC will then initiate discussions with the respective Federal and State agencies and other in-house Corps elements to review possible drought concerns and future Corps actions.

7. DESCRIPTION OF EXISTING WATER SUPPLY CONDITIONS

a. General: The area of concern is a portion of the central region of New Hampshire in the vicinity of Franklin Falls Dam. Table 1 contains information about public water suppliers in this area based on information provided by the New Hampshire Water Supply and Pollution Control Commission. The information was taken from the Facilities and Policy Summary published in 1983. Of the 16 communities viewed as potential users of water from Franklin Falls Dam during drought conditions, 13 of the communities are at least partially served by public water supply systems. No data is available for those areas dependent on private individual water supplies.

b. Water Supply Systems: The primary objective of this analysis was to accumulate available data regarding water supply systems in the vicinity of Franklin Falls Dam that could benefit from storage at the project, and to present the data in a manner portraying existing water supply conditions. Projections of future demands were not developed because this study addresses only modifications in the operational procedures at Franklin Falls Dam in order to provide storage for water supply purposes when drought conditions exist, and not to meet normal water supply demands at some future date.

c. Public Water Suppliers: As noted in Table 1, the data given for each water supplier includes: community served, estimated population served by the system, source of supply (ground or surface water), average day and maximum day demands for 1983, and the estimated safe yield of each source where available. An analysis of the adequacy of existing sources during drought conditions has not been performed. The information is shown to present a summary of the existing water supply conditions for the central New Hampshire area. Those communities in the vicinity of Franklin Falls Dam without a water supply system include Canterbury, Salisbury, and Sanbornton.

d. Population Projections: Population projections for communities in central New Hampshire are given in Table 2 to show population trends for each community potentially affected by a prolonged dry period. The population projections were provided by the New Hampshire Office of State Planning. This information indicates areas of potential future growth in the south central New Hampshire area.

Table 1
Major Water Suppliers - South Central New Hampshire

Company or Agency	Town Served	Est. Population Served -- 1983	Source of Supply (SW/GW)	1983 Demand Avg. Day (MGD)	1983 Demand Max. Day (MGD)	Supply Source	Safe Yield (MGD)
Andover Village Dist.	Andover	600	SW	N/A	N/A	Bradley Lake	N/A
Belmont Water Works	Belmont	840	GW	0.07	0.30	Gravel Packed Wells #1, #2	0.40
Boscawen/Penacook Water Precinct	Boscawen	2,900	SW	0.58	0.92	Walker Pond	2.20
Bristol Water Works	Bristol	N/A	GW	0.75	1.20	GP #1 Storm Center	0.70
						GP #2 Fowler River	2.30
	Canterbury	No public system					
Concord Water Works	Concord	28,000	GW/SW	4.08	6.55	Long Pond	2.60
						Contoocook River	10.00
						GP #1	1.00
						GP #3	1.00
						GP #5	1.00
						GP #7	1.00
Franklin Water Dept.	Franklin	7,000	GW	N/A	N/A	GP #1	0.75
						GP #2	1.00
						Sanbornton Well	1.00
Hill Water Works	Hill	400	N/A	N/A	N/A	N/A	N/A
Laconia Water Works	Laconia					Lake Winnipesaukee intakes:	
Paugus Bay Syst.		16,500	SW	1.65	2.50	Paugus Bay	3.00
Weirs Beach Syst.		5,600	SW	0.15	0.60	Weirs Beach	0.50
Meredith Water Dept.	Meredith	9,900	SW	0.20	0.57	Meredith Reservoir	0.10
						Lake Waukewan	7.40
New Hampton Village Precinct	New Hampton	510	SW	0.03	0.10	Mountain Pond	0.20
	Northfield	Served by Tilton-Northfield Aqueduct					
	Salisbury	No public system					
	Sanbornton	No public system					
Tilton-Northfield Aqueduct	Tilton	3,500	SW	0.30	N/A	Knowles Pond	0.20
Pillsbury Lakes Dist.	Webster	300	GW	N/A	N/A	Wells	N/A

N/A - Not Available

Table 2
Population Projections - South Central New Hampshire

Town	Actual 1980	1985	1990	1995	2000	Percent Change 1980-2000
Andover	1,587	1,771	1,889	2,113	2,362	48.83
Belmont	4,026	4,836	5,392	6,304	7,079	75.83
Boscawen	3,435	3,661	4,372	5,002	5,661	64.80
Bristol	2,198	2,414	2,545	2,765	3,009	36.90
Canterbury	1,410	1,648	1,943	2,336	2,759	95.67
Concord	30,400	31,890	32,851	34,473	36,257	19.27
Franklin	7,901	7,890	8,499	8,927	9,392	18.87
Hill	736	744	902	1,031	1,177	59.92
Laconia	15,575	15,761	16,650	17,407	18,140	16.47
Meredith	4,646	4,615	5,795	6,607	7,345	58.09
New Hampton	1,249	1,407	1,471	1,630	1,778	42.35
Northfield	3,051	3,341	3,920	4,555	5,236	71.62
Salisbury	781	816	1,006	1,170	1,346	72.34
Sanbornton	1,679	1,855	2,167	2,509	2,814	67.60
Tilton	3,387	3,689	4,063	4,541	4,981	47.06
Webster	1,095	1,241	1,639	2,026	2,423	121.28
	83,156	87,579	95,104	103,396	111,759	34.40

8. POTENTIAL FOR WATER SUPPLY REALLOCATION

a. General: There are several authorities that provide for the use of reservoir storage for water supply at Corps of Engineers projects. They vary from the provision of water supply storage as a major purpose in new projects to the discretionary authority to provide emergency supplies to local communities in need. In addition, guidance contained in ER 1110-2-1941 directs field offices to determine the short-term water supply capability of existing Corps reservoirs. Congressional authorization is not required to add municipal and industrial water supply if the related revisions in regulation would not significantly affect operation of the project for the originally authorized purposes.

b. Drought Contingency Storage: In the design of flood control reservoirs in New England, it has been found that flood control storage capacity equivalent to six to eight inches of runoff from the contributing watershed was a reasonable amount of storage that should be sought as a general rule where some small degree of risk could be accepted but a high degree of protection was justified. The median storage capacity of 28 projects operated by the Corps of Engineers in New England is 6.8 inches. Franklin Falls, with a storage capacity of 2.8 inches of runoff from its watershed, has the lowest storage capacity per unit watershed area in the system. For that reason it was determined that drought contingency storage could not take place at Franklin Falls without adverse impacts on the project's primary purpose, flood control.

However, a low flow duration analysis was performed to determine minimum dependable flows in the river at the project that would be available under emergency drought conditions. There is no stream gaging station directly below Franklin Falls Dam on the Pemigewasset River. The Franklin Junction USGS gage, approximately 4 miles downstream of the dam on the Merrimack River, has measured flows below the confluence of the Pemigewasset and the highly regulated Winnipesaukee River for 63 years and was used for this analysis. A flow adjustment of 250 cfs was subtracted from the gage data to account for Winnipesaukee River low flows. The adjusted 10 percent chance (10-year) and 1 percent (100-year) low flows for the Pemigewasset River downstream of Franklin Falls Dam are shown on Table 3. The 1 and 3 day low flow values have not been listed as they are significantly affected by short-term regulation and are not considered representative of natural low flow conditions.

c. Effect of Diverted Flows: The diversion of flows from the Pemigewasset River at Franklin Falls Dam during a drought emergency could adversely impact on the flowage rights of downstream riparian users. At this time, however, it is not possible to review all of the various drought emergency situations that could occur, nor is it within the scope of this report to identify all those with water rights. In a drought emergency the goal would be to operate in the public interest established by weighing the needs and rights of known users and through consultation with responsible state officials.

Table 3

FRANKLIN FALLS DAM
ALL-SEASON LOW FLOW DURATION

Low Flow Period (Days)	10% CHANCE (10-yr) Avg. Low Flow (cfs)	1% CHANCE (100-yr) Avg. Low Flow (cfs)
7	301	141
14	344	174
30	388	201
60	478	275
90	541	328
120	608	381

NOTE: The 1 and 3 day values have not been shown as they are significantly affected by short-term regulation and are not considered representative of natural low flow conditions.

9. WATER QUALITY EVALUATION

a. Water Quality Classification:

The Pemigewasset River, as it flows through the Franklin Falls Dam project, is rated class B by the New Hampshire Water Supply and Pollution Control Commission. This is not a statement of the existing water quality conditions in the river but rather of the water quality goals for the Pemigewasset River.

Class B waters are managed to achieve a high level of quality which consistently exhibit good aesthetics and provide a high quality of habitat for aquatic biota, fish and wildlife. Class B waters are acceptable for public water supply after filtration and disinfection; irrigation and other selected agricultural uses; swimming and other water contact recreation.

Class B waters are managed to prevent objectionable physical characteristics. Sewage or waste disposal is prohibited, unless adequately treated.

Technical requirements for class B waters include dissolved oxygen (DO) levels not less than 75 percent of saturation nor less than 6 mg/l, pH in the range of 6.5 to 8.0 standard units or as naturally occurs, total coliform bacteria counts that do not exceed 240 per 100 ml, and turbidity levels below 25 JTU's.

b. Existing Water Quality:

Water quality data collected at the Franklin Falls Dam indicates that the waters of the project are of good quality, meeting or exceeding State of New Hampshire class B water quality criteria. Indicative of its good water quality are consistently high DO levels and generally low levels of turbidity and coliform bacteria.

However, some objectionable levels have been observed for various water quality parameters, including color and heavy metals. Nutrient levels in the Pemigewasset River are high enough to sustain nuisance algal blooms but algal development is prevented by the short hydraulic detention time associated with the small pool at the project.

Color levels at the project have been and continue to be moderately high. These high levels of color can be attributed to the organic materials from swamps and marshes situated in the project's headwaters. If the water was to be used for a potable water supply, treatment through flocculation and sedimentation, or multi-media filtration would be necessary to correct this undesirabe color problem.

Moderate levels of iron and manganese are occasionally found at the Franklin Falls project apparently due to the leaching of iron from the ground by waters naturally low in pH. While not a health hazard, iron and manganese cause taste and laundry staining problems in a public water supply. Manganese as well as iron levels are generally above the maximum criteria for drinking water but seldom exceed the maximum criteria set to protect sensitive aquatic organisms. Excess iron and manganese can be removed through flocculation and sedimentation or filtration. If the water at Franklin Falls Dam was to be used for public water supply, the manganese and iron levels should be monitored.

There are 11 significant point source discharges upstream from Franklin Falls Dam. Included in these discharges are 7 municipal, 2 industrial and 2 fish hatchery discharges. While these discharges presently have a minimal effect on the project's water quality, a malfunction at one site could result in a significant, though temporary impact. Consequently, if the water at Franklin Falls Dam was to be used for public water supply, water quality monitoring would be required.

Water quality conditions at Franklin Falls Dam can be expected to remain at recent levels unless some change is made in the upstream watershed.

c. Water Quality Requirements for Supplemental Water Supply:

In defining the water quality requirements for possible stream withdrawal during drought conditions, there exist two conditions that must be met. The waters must satisfy state standards for surface waters and must be of a quality suitable for the water supply users. A water which meets class B standards in New Hampshire is acceptable for public water supply after filtration and disinfection. The water quality required for industrial water supply depends on the industrial process involved. The water at Franklin Falls Dam would always be of a quality suitable for firefighting and irrigation.

d. Water Quality Conclusions:

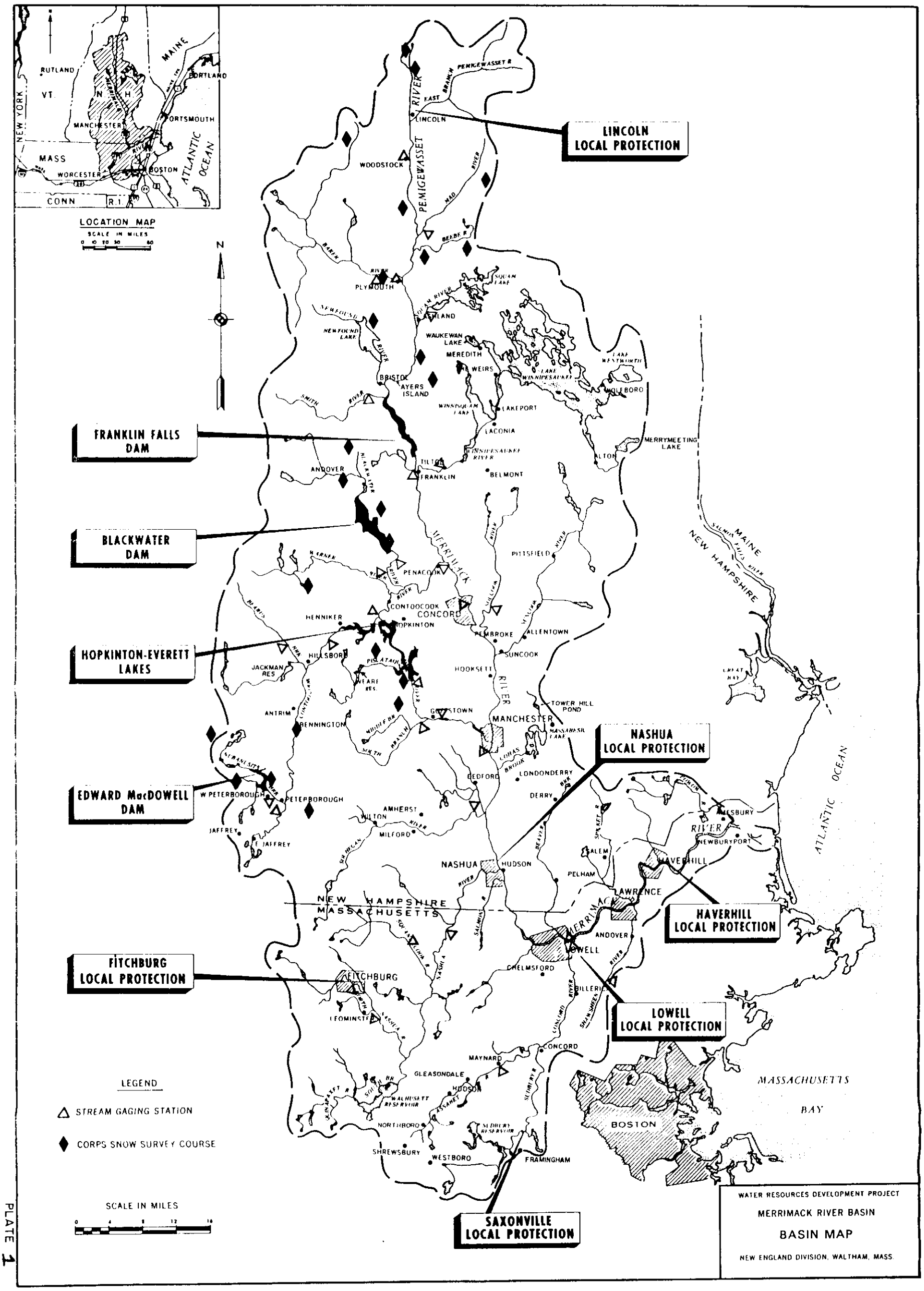
The water at Franklin Falls Dam is of good quality and should be acceptable for public water supply following flocculation and sedimentation to remove iron and manganese and filtration with disinfection to remove color, turbidity and bacteria. No treatment should be required for the water to be suitable for irrigation, firefighting, groundwater recharge and selected industrial processes.

If the water at Franklin Falls Dam was to be used for public water supply, a sampling program should be implemented at the project to monitor the levels of color, turbidity, coliform bacteria and heavy metals.

10. SUMMARY AND CONCLUSIONS

Franklin Falls Dam is located on the Pemigewasset River in central New Hampshire in a region where existing 12 water supply systems service about 87,600 people. Because of its limited flood control storage capacity per unit of watershed area, it was determined that drought contingency storage could not take place at Franklin Falls Dam without significant impact on its flood control function.

Water quality is good at Franklin Falls Dam and the river could be used as a public water supply source with the proper treatment. A low flow analysis was performed to determine minimum dependable flows in the river at the project that would be available under emergency drought conditions However diversion of river flows for the purpose of water supply could adversely impact flowage rights of downstream riparian.


LOCATION MAP
SCALE IN MILES
0 10 20 30 60
NEW YORK
VT.
N. H.
MAINE
MASS
CONN
R.I.
RUTLAND
MANCHESTER
WORCESTER
BOSTON
PORTLAND
PORTSMOUTH
ATLANTIC OCEAN
N
LINCOLN LOCAL PROTECTION
FRANKLIN FALLS DAM
BLACKWATER DAM
HOPKINTON-EVERETT LAKES
EDWARD MacDOWELL DAM
FITCHBURG LOCAL PROTECTION
NASHUA LOCAL PROTECTION
HAVERHILL LOCAL PROTECTION
LOWELL LOCAL PROTECTION
SAXONVILLE LOCAL PROTECTION
LEGEND
STREAM GAGING STATION
CORPS SNOW SURVEY COURSE
SCALE IN MILES
0 4 8 12 16
WATER RESOURCES DEVELOPMENT PROJECT
MERRIMACK RIVER BASIN
BASIN MAP
NEW ENGLAND DIVISION, WALTHAM, MASS.
PLATE 1

FRANKLIN FALLS RESERVOIR
AREA AND CAPACITY
(D.A. = 1,000 Sq. Mi.)

Pool Elev. Ft, Msl	Area Acres	Capacity Ac/Ft	Capacity Inches
307(1)	440	3,100	.06
308	470	3,600	.07
309	500	4,200	.08
310	525	4,800	.09
311	550	5,400	.10
312	580	6,000	.11
313	605	6,600	.12
314	630	7,200	.14
315	655	7,800	.15
316	685	8,500	.16
317	715	9,200	.17
318	750	10,000	.19
319	785	10,800	.20
320	825	11,600	.22
321	875	12,500	.23
322	920	13,400	.25
323	970	14,300	.27
324	1,020	15,300	.29
325	1,075	16,400	.31
326	1,125	17,600	.33
327	1,185	18,900	.35
328	1,245	20,200	.38
329	1,310	21,500	.40
330	1,370	22,900	.43
331	1,425	24,300	.46
332	1,475	25,700	.48
333	1,520	27,200	.51
334	1,560	28,700	.54
335	1,605	30,300	.57
336	1,645	31,900	.60
337	1,675	33,600	.63
338	1,710	35,300	.66
339	1,745	37,000	.69
340	1,775	38,800	.73
341	1,805	40,500	.76
342	1,830	42,300	.79
343	1,860	44,200	.83
344	1,885	46,100	.86
345	1,915	48,000	.90
346	1,940	50,000	.94
347	1,965	52,000	.98
348	1,990	54,000	1.01
349	2,015	56,000	1.05
350	2,040	58,000	1.09
351	2,065	60,100	1.13
352	2,085	62,200	1.17
353	2,110	64,300	1.21
354	2,130	66,400	1.25
355	2,155	68,500	1.28
356	2,175	70,700	1.33
357	2,195	72,900	1.37
358	2,215	75,100	1.41
359	2,235	77,300	1.45
360	2,255	79,500	1.49
361	2,275	81,700	1.53
362	2,295	84,000	1.58
363	2,315	86,300	1.62
364	2,335	88,600	1.66
365	2,350	91,000	1.71
366	2,370	93,400	1.75
367	2,390	95,700	1.79
368	2,405	98,100	1.84
369	2,425	100,500	1.88
370	2,440	102,900	1.93
371	2,455	105,300	1.97
372	2,475	107,700	2.02
373	2,490	110,100	2.06
374	2,510	112,500	2.11
375	2,530	115,000	2.16
376	2,550	117,500	2.20
377	2,570	120,000	2.25
378	2,585	122,700	2.30
379	2,605	125,100	2.35
380	2,625	128,100	2.40
381	2,645	130,900	2.45
382	2,665	133,700	2.51
383	2,685	136,500	2.56
384	2,705	139,300	2.61
385	2,725	142,000	2.66
386	2,745	144,800	2.72
387	2,760	147,600	2.77
388	2,780	150,600	2.82
389(2)	2,800	153,700	2.88
390	2,825	156,400	2.93
391	2,850	159,200	2.99
392	2,870	162,100	3.04
393	2,895	164,900	3.09
394	2,290	167,700	3.14
395(3)	2,945	170,500	3.20

(1) Normal Pool, (2) Spillway Crest Elevation, (3) Fee Elevation

PERTINENT DATA
FRANKLIN FALLS DAM

LOCATION — Pemigewasset River, Franklin, New Hampshire

DRAINAGE AREA — 1,000 square miles

STORAGE USE — Flood control

RESERVOIR STORAGE

	Stage (ft, msl)	Area (acres)	Capacity: Acre-Feet	Capacity: Inches on Drainage Area
Invert Elevation	300	0	0	0
Permanent Pool*	307±	440	3,400	0.1
Spillway Crest	389	2,800	150,600 (net)	2.8 (net)
Maximum Surcharge (Des. Criteria)	411.8	3,340	68,000 (net)	1.3 (net)
Top of Dam	416			

*Backwater from Eastman Falls Dam (Public Service Company of New Hampshire), 1.8 miles downstream

EMBANKMENT FEATURES

Type	Rolled earth fill with rock slope protection
Length (feet)	1,740
Top Width (feet)	35
Top Elevation (ft, msl)	416
Height (feet)	140
Volume (cubic yards)	3,070,000
Dike	None

SPILLWAY

Location	Right, west abutment
Type	Chute spillway, ogee weir
Crest Length (feet)	546
Crest Elevation (ft, msl)	389
Surcharge (feet) (1973 studies)	24.9
Max. Discharge Capacity (cfs) (1973 studies)	243,000

OUTLET WORKS

Type	Two horseshoe conduits
Tunnel Inside Diameter (feet)	22
Tunnel Length (feet)	542
Service Gate Type	Four - each conduit, broome
Service Gate Size	Three @ 7'6" x 16', one @ 4'6" x 10'
Normal Max. Release Rate (cfs)	18,000
Maximum Discharge Capacity - Spillway Crest Elevation	41,000 cfs
Stilling Basins	Two (one for each conduit) - each 85' wide x 95' long

LAND ACQUISITION

Fee Elevation (ft, msl)	395
Fee (acres)	3,897
Easement (acres)	15

MAXIMUM POOL OF RECORD

Date	March 1953
Elevation (ft, msl)	376
Percent Full	76

SPILLWAY DESIGN FLOOD

	Design Criteria	1973 Studies
Peak Inflow (cfs)	210,000	300,000
Peak Outflow (cfs)	205,000	286,000**
Volume Runoff (acre-feet)	710,000	693,000

** 243,000 spillway discharge - 43,000 conduit discharge

UNIT RUNOFF

One Inch Runoff (acre-feet)	53,300

OPERATING TIME

Open/Close All Gates	Approximately 20 minutes
PROJECT COST (THROUGH FY 74)	$7,950,000
DATE OF COMPLETION	October 1943
MAINTAINED BY	New England Division, Corps of Engineers